

ON THE RADULE OF THE BRITISH HELICIDS. PART IV.

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Read 8th May, 1914.

THREE parts of this paper appeared in vol. viii of these Proceedings. Part III, together with the present contribution, will be found to contain figures of all the species referred by Dr. Gwyn Jeffreys to the genus *Helix*.¹ All the larger species, except *Theba cartusiana* and *Hygromia fusca*, have already been figured and described.

THEBA CARTUSIANA.—The central and admedian unci differ in the following minor points from those of *Th. cantiana*:—

1. The central uncus is proportionally larger.
2. The ectocones are less prominent.
3. The apices are shorter and have less sinuosity of outline. In the more lateral admedians the apices tend to become pointed. The apical fossa is not conspicuous.
4. The posterior margins are decidedly less prominent.
5. There is a well-marked indentation of the lacinia.



The external unci are remarkably different in appearance. This is, however, mainly due to their cones being produced into regular styloid processes. If the average proportion of width to length be represented as about 2 : 3 in *cantiana*, in *cartusiana* it reaches 1 : 4. Also, the apices are markedly triangular. The median part of each uncus overlaps the lateral part of the next, but there is no fusion.

The diagnosis of *cartusiana* is therefore easily made, but it is clearly of the same type as *cantiana*. The great difference between the proportions of the external cones furnishes another instance of the principle that prominence in any given character takes the forms of excess and defect in allied species. On comparing these two forms I am disposed to think *cartusiana* to be the earlier, because there is a distinct tendency to thickening of the cone elements, especially on the externals, in the more developed forms. The embryonic *cantiana* exhibits externals more nearly resembling those of *cartusiana*.

It may be suggested that habitat and food have played their part in determining the form of these unci. I have only once found *cartusiana*: the animals were feeding upon thistles in an exposed

¹ The radula of *Vallonia pulchella* (Müll.) has not been figured, as I was unable to obtain specimens from shells which belonged without doubt to this species.

place near the seashore. On other plants in the vicinity none was to be found, though *cantiana*, *virgata*, and *itala* were abundant. But a reference to Part III will show that all these species have radulæ sufficiently distinct.

HELICELLA GIGAXIL.—I have not yet examined with sufficient minuteness. Boycott & Standen have given an account of its radula (Journ. Conch., vol. xiv, p. 165).

HYGROMIA FUSCA is nearer to *granulata* than to any other of our species; it differs from *granulata* in the following respects:—

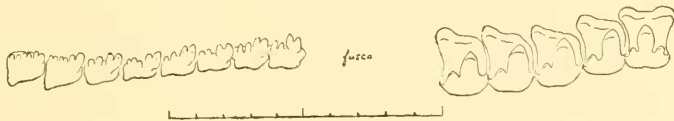
1. All the unci are relatively wider: centrals and admedians roughly equal in length and breadth; externals markedly oblong.

2. The lateral curve of the admedian basal plate is much more pronounced.

3. The apices are blunter.

4. External ectocones are more nearly equal in length to the corresponding mesocones. The prevailing number is two, but there may be three, or the original two may be subdivided to form four. These external cones, regarded as groups, show less tendency to slant laterally and anteriorly than those of any allied species.

Sometimes it is quite difficult to see the medial cusp of the external mesocone, owing to the very regular overlapping which occurs here. If this cusp is not observed, it may easily be supposed that the radula belongs to the type found in the commoner *Hygromia*.



It is, however, always present, i.e. this mesocone is undoubtedly bifid. This radula is very distinct. The very short external cones are remarkable. A similar type occurs in *Helix spirorbis*, Lowe, from Madeira.

The bifid external mesocone is found in *pomatia*, *aspersa*, *nemoralis*, *hortensis*, *arbustorum*, *obvoluta*, *lagicida*, *caperata*, *itala*, *barbara*, *granulata*, and *fusca*. It also occurs in *Vallonia* and *Acanthinula*. In the allied groups *Clausilia* shows it, and it is present, though less marked, in *Cacilioides*. Whether it is really present in the *Pyramidule* will be discussed under those species.

Mr. Reynell kindly gave me the remains of an *EULOTA FRUTICUM*. The radula is very similar to that of *Th. hortensis*, so that in the possible event of abnormal specimens of *Th. cantiana* being mistaken for *fruticum*, a ready and certain means of differentiation exists in this character of bifid external mesocones.

We have so few described species among the smaller *Helices* that comparative descriptions are not required. The *Vallonia* or *Acanthinula* radula can be distinguished at a glance; *rotundata*, *rupestris*, and *pygmaeum* have striking individual peculiarities.

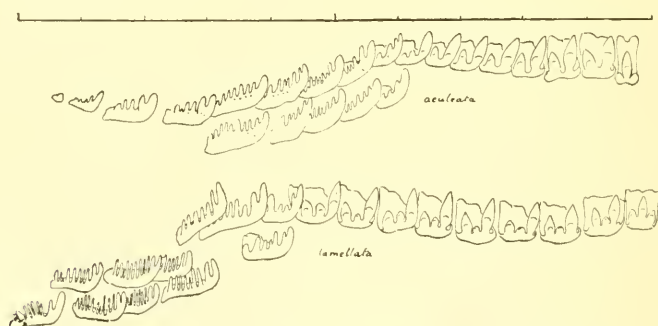
The *VALLONIAE* differ from all other *Helicids* in the marked diminution of size of the centrals compared with the admedians, and

the concomitant enlargement of the first (or first and second) admedian. Of the two species most prevalent in this country *excentrica* exhibits the large admedian best, and *costata* the small central. The first three or four basal plates are sub-quadrate. The admedians have the shape of a capital L, i.e. there is a diastema between mesocone and ectocone. This is characteristic of many Pupidae. One or two rows of transitionals are present; there are



three typical admedians in *excentrica* and four in *costata*. The externals (not counting the first or last) have six rounded pectinations in *excentrica* and four in *costata*. They have a strong lateral and posterior inclination, the basal plates being obtuse-angled parallelograms. The more median cones are considerably larger than the others.

Cacilioides acicula has a somewhat similar radula; but here the admedians have well-developed endocones, which do not occur in any

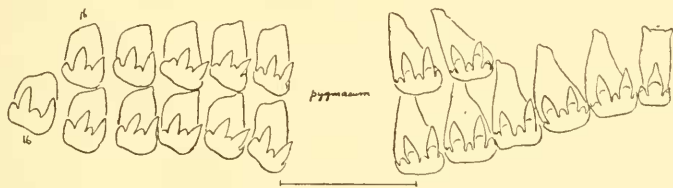


Helicid, so far as I am aware. The externals also are more numerous, oblong, and regularly pectinated, if one may use that term in describing cones so extremely short and rounded. Nevertheless, the resemblance seems very well worth noting.

In ACANTHINULA we also have squared admedian basal plates. The admedians number six or seven. The most salient character is the curved combined median and anterior margin of the external

mesocones and basal plates, for at this margin no line of demarcation can be drawn between them. In consequence the external pleuræ present the appearance of numerous little crescents, sloping away from the admedian regions, and there is a good deal of overlapping, on account of the unusual convexity of the radular membrane. There is apparently a tendency to true longitudinal fusion of these externals. The externals are highly pectinate, the pectinations being more frequent and more filiform in *lamellata*.

This genus also shows great variation in the form and proportion of the central and admedian cones. *Lamellata* can be known at once by the presence of an additional small cone between the admedian mesocone and its ectocone. (Similar structures are found in *Punctum*; they are extremely prevalent in the genus *Succinea*.) The mesocones of the more lateral admedians of both species are long and lancet-shaped, and have a tendency to slant inwards. *Aculeata* has a very narrow central, that of *lamellata* being distinctly wide. They closely resemble those of *Punctum pygmæum* and *Vertigo moulinsiana* respectively. As in the *Vallonia* and in *Punctum*, the actual number of unci on each side of the central is small—from thirteen to sixteen in adult specimens.

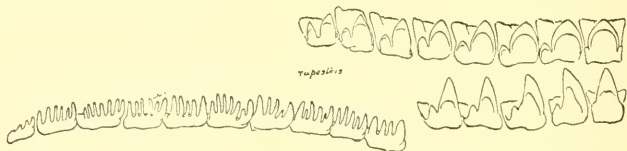


With regard to *rotundata*, *rupestris*, and *pygmæum*, it may be repeated that each has a most characteristic radula, and each exhibits a distinct type. If we examine the basal plates we find that in *PUNCTUM PYGMÆUM* the centrals are like those of a *Succinea*, and this resemblance is continued as we trace the rows outwards on the pleuræ. All the basal plates are sub-triangular, the inner side being slightly convex and having a tendency to be slightly notched; and the size of the basal plate of the first admedian and that of the last (sixteenth) unci is approximately the same. A secondary pleural appearance, probably not indicating a true pleural division, is found after the ninth row from the centre. The ninth admedian is the last which has its basal plate pointing straight backwards to the unci of the succeeding row; that of the tenth admedian points to the space between the tenth and eleventh unci of the row behind it; the eleventh points straight at the twelfth succeeding unci, and this new parallelism is maintained to the end, so that the sides of the radula acquire a fan-like appearance. Simultaneously the angle of insertion of the cones is varied so as to increase the illusion. This arrangement is quite typical in *Succinea*. It is also found in *Orthalicus*. In the *Vertiginidæ* we find some radulæ quite close to that of *Punctum*, closely allied species having the organ developed

very much after the *Acanthinula* pattern, so that, although these two are distinct enough as types, yet the intermediate forms are found.

I have figured the *Punctum* radula as possessing no external unci. It is, however, possible to find at the extreme margin in some specimens one or two rows which forsake the oblique direction above described, and appear to have wider basal plates bearing pectinations. Pectinated externals are quite commonly found in the embryonic radulæ of more highly developed forms; they may be seen, for example, in the embryonic radula of *Agriolimax levis*; thus one may be sure that the aculeate external is a later development.

PYRAMIDULA RUPESTRIS has a radula which is superficially very much like that of the young *Helicigona lapicida*. The cones are low and fairly uniform in length; the external basal plates are long and narrow; there is even an indication of the bifid external mesocone so characteristic of the larger *Helices*. Also the radula itself is (as in *lapicida*) rather abruptly divided into a central and two pleural regions; consequently it is rather difficult to make it lie flat on a microscope slide. The radulæ of *Punctum* and *Orthalicus* can be spread out quite easily, although they are very broad relatively to the size of the head.

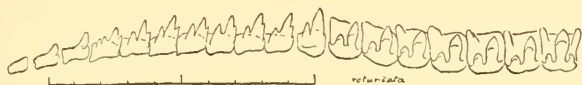


The rounding of the cones in the central region of this radula is perhaps due in some way to the habitat of the species. They are not rubbed down to this shape; if a different view be taken of them they may even appear lanceolate, as in the second row shown in the figure. This is true of *lapicida* also. A view of the entire radula shows the aspect of rounded cones as normal, the lanceolate appearance being seen in displaced rows.

In the larger *Helices* the oldest and most anterior part of the radula is found to taper to a point, so that if the specimen is entire the first row consists of one central uncus alone, or one central and an admedian on each side. If great care be taken to dissect them out, one may occasionally find one or two surviving pectinate unci beside these. Now and then (especially in *Th. cantiana*) one may find a regular pectinated row external to the normal externals on one or both sides of the radula throughout its length. In the small species which normally have pectinate externals in the adult stage there is little or no tapering of the anterior end; the first row may contain as many unci as the last. This is the case with *P. rupestris*, and therefore I think it is rightly placed with the Pupiform *Helices*, though at the same time I regard it as a very specialized form.

Our last species is PYRAMIDULA ROTUNDATA. This certainly does not belong to the pectinate group. The serrations upon its externals are very regular and unlike those of any other British *Helicid*. The

embryo of *Arion hortensis* shows very similar externals and admedians. *Rotundata* appears to show a bifid external mesocone, but I do not think the structure is homologous with that of the larger Helices. It is not constant, specimens occurring with this cone (or rather blade) simple. This radula does not show close affinity with that of any other of our species, but it is much nearer to that of *Hygromia hispida* than *P. rupestris*. Several of the apparently allied foreign forms which I have examined have turned out to have radulæ of the *Hygromia* type.



The magnification of each of the accompanying figures may be ascertained from the scale. The two *Fallonia* are drawn to the same scale; the *Acanthinula* and *P. rupestris* may be measured by the scale shown with the figure of *A. aculeata*. In every case each division of the scale represents 10μ (one-hundredth part of a millimetre).